Integrative Biology and Adaptation of Antarctic Organisms:

An International Training Program for New Polar Scientists

Since 1994 the US National Science Foundation has supported a series of nine advanced biology courses in Antarctica (McMurdo Station). The goals for these month-long training programs are to introduce graduate students and early career post-doctoral scientists to key questions at the frontiers of polar research, and to provide an opportunity for first-hand experience in Antarctic fieldwork and logistics. A combination of lectures, laboratory work and field trips emphasize the unique physiological, biochemical and molecular aspects of understanding the ecology, diversity and biological adaptations of Antarctic organisms. Participants gain a rigorous understanding of the power, but also the limitations, of field and laboratory methods that can be applied to address questions in polar science. The US Antarctic Program's Crary Science and Engineering Center provides state of the art laboratory facilities within a short distance from marine and freshwater environments where biological observations and collections of material are made. The course attracts an extremely competitive group of early career scientists and there have been over 200 participants representing more than 120 institutions in 24 countries. Course alumni have successfully established new research projects in a number of national polar science programs.

Impacts

- Established the first formal graduate education program in Antarctica
- Increasing incorporation of the global importance of Antarctic science in academic curricula at participant home institutions
- Fostering the expansion of the international polar community with 'next generation' scientists
- Launching new research directions and opportunities for numerous early-career polar scientists

Summary Statistics

228 Participants
127 Institutions in 24 countries
29 Nationalities

Representation By Nationality

Australia	Austria	Belgium
Brazil	Canada	Croatia
Denmark	Finland	France
Germany	India	Israel
Italy	Japan	Luxembourg
Mexico	Netherlands	New Zealand
Norway	P.R. China	Russia
South Korea	Spain	Sri Lanka
Sweden	Switzerland	Thailand
United Kingdom		USA

2008 Antarctic Biology Class at Scott's Discovery Hut with McMurdo Station in background

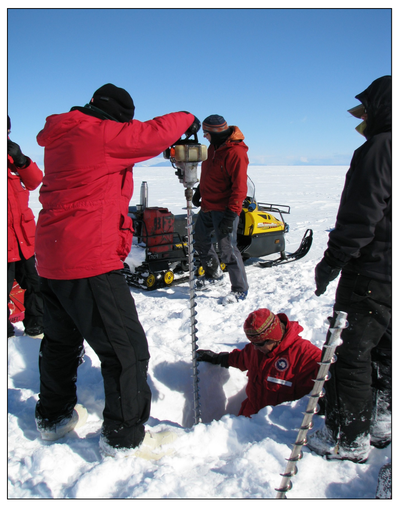
Field trip to Cape Evans

Course Format: The over-arching course themes relate to physiological adaptations and ecological aspects of climate change. In addition to morning and evening lectures by course faculty and guest lecturers, participants gain field and laboratory experience centered on key areas of polar research:

- ***Biodiversity***: Characterization of community structure utilizing classical taxonomic techniques and cutting-edge molecular technologies (e.g., DNA cloning and sequencing, functional genomics)
- ***Variable Environment***: Investigation of physiological responses to the seasonally changing aspects of the polar environment (e.g., ultraviolet and visible light fields, food availability)
- ***Constant Environment***: Evaluation of adaptive strategies for surviving the constant and extreme cold polar temperatures (e.g., expression of stress response proteins)

Ice edge

McMurdo Station



Sampling on sea ice

Institutions of Course Participants	*Country*
Arizona State University	United States
Auburn University	United States
Autonomous University of Madrid	Spain
Bangor University	United Kingdom
Bowling Green State University	United States
California Institute of Technology	United States
California State University, North Ridge	United States
Carnegie Mellon University	United States
Center for Cellular and Molecular Biology	India
Dalhousie University	Canada
Desert Research Institute, University of Nevada	United States
Duke	United States
Eckerd College	United States
Florida State University	United States
Graduate University of Advanced Studies	Japan
Griffith University	Australia
Harbor Branch Oceanographic Institution	United States
Jet Propulsion Laboratory	United States
Karolinska Institute	Sweden
Lafayette College	United States
Leibniz Institute of Freshwater Ecology	Germany
Marine Biological Laboratory, Woods Hole	United States
Massachusetts Institute of Technology	United States
Max Planck Institute for Developmental Biology	Germany
Max Planck Institute for Marine Microbiology	Germany
McGill University	Canada
McMaster University	Canada
Michigan State University	United States
Montana State University	United States
Monterey Bay Aquarium Research Institute	United States
Moss Landing Marine Laboratory (CSU)	United States
Museum Barcelona	Spain
NASA Ames Research Center	United States
Northern Kentucky University	United States
Northwestern University	United States
Norwegian Polar Institute	Norway
Oak Ridge Associated Universities	United States
Oak Ridge National Laboratory	United States
Ocean Research & Development Institute	South Korea
Ocean University of China	People's Republic of China
Ohio State University	United States
Ohio University	United States
Oregon State University	United States
P.P. Shirshov Institute of Oceanology	Russia
Plymouth Marine Laboratory	United Kingdom
Portland State University	United States
Royal Netherlands Institute for Sea Research	Netherlands
Ruder Boskovic Institute	Croatia
Rutgers University	United States
Simon Fraser University	Canada
Smithsonian Environmental Research Center	United States
Spanish Oceanographic Institute	Spanish
Stanford University	United States
State University of New York, Stony Brook	United States
Texas A&M University	United States
The 2nd University of Naples	Italy
The Institute for Genomic Research	United States
University of Aberdeen	United Kingdom
University of Alabama, Birmingham	United States
University of Amsterdam	Netherlands
University of Auckland	New Zealand
University of Bath	United Kingdom
University of British Columbia	Canada
University of California, Berkeley	United States
University of California, Davis	United States
University of California, Los Angeles	United States
University of California, San Diego	United States
University of California, Santa Barbara	United States
University of California, Santa Cruz	United States
University of Cambridge	United Kingdom
University of Colorado, Boulder	United States
University of Connecticut	United States
University of Copenhagen	Denmark
University of Delaware	United States
University of East Anglia	United Kingdom
University of Geneva	Switzerland
University of Georgia	United States
University of Guelph	Canada
University of Hawaii	United States
University of Illinois, Urbana-Champaign	United States
University of Kansas	United States
University of Konstanz	Germany
University of Liège	Belgium
University of Liverpool	United Kingdom
University of Maine	United States
University of Malaga	Spain
University of Maryland	United States
University of Massachusetts	United States
University of Minnesota	United States
University of Nantes	France
University of Naples	Italy
University of New England	United States
University of New Mexico	United States
University of New South Wales	Australia
University of North Carolina, Chapel Hill	United States
University of Oregon	United States
University of Otago	New Zealand
University of Ottawa	Canada
University of Plymouth	United Kingdom
University of Quebec, Rimouski	Canada
University of Queensland	Australia
University of Rostock	Germany
University of São Paulo	Brazil
University of San Francisco	United States
University of Sheffield	United Kingdom
University of South Alabama	United States
University of South Carolina	United States
University of South Florida	United States
University of Southampton	United Kingdom
University of Southern California	United States
University of St. Andrews	United Kingdom
University of Sydney	Australia
University of Tasmania	Australia
University of Texas, Austin	United States
University of Texas, Galveston	United States
University of Toronto	Canada
University of Turku	Finland
University of Vienna	Austria
University of Washington	United States
University of Western Florida	United States
University of Wisconsin, Milwaukee	United States
University of Wyoming	United States
Uppsala University	Sweden
US National Science Foundation	United States
Woods Hole Oceanographic Institute	United States
Yale University	United States

Donal Manahan, ***Course Director*** University of Southern California

2010 Course Faculty		***2010 Laboratory Instructors***	
Mark Denny	Stanford University	Scott Applebaum	University of Southern California
Deneb Karentz	University of San Francisco	Mark Brown	University of New South Wales
Alison Murray	Desert Research Institute	Judith Connor	Monterey Bay Research Institute
George Somero	Stanford University	William Dowd	University of California, Davis
		David Ginsburg	University of Southern California
		Jimmy Lee	University of Southern California
		James Leichter	Scripps Institution of Oceanography
		Blaire Steven	University of Wyoming

Crary Lab

http://antarctica.usc.edu/